


## 4.4b Modeling and Optimization

Designing a can


1000 cc  
You have been asked to design a one-liter oil can shaped like a right-circular cylinder. What dimensions will use the least material? SA

Variables  
height =  $h$   
radius =  $r$



$V = \pi r^2 h$   
1000 =  $\pi r^2 h$  (Constant)

$SA = 2\pi r h + 2\pi r^2$   
 $h = \frac{1000}{\pi r^2}$   
 $SA = 2\pi r \cdot \frac{1000}{\pi r^2} + 2\pi r^2$   
 $SA = \frac{2000}{r} + 2\pi r^2$   
 $SA' = 4\pi r - \frac{2000}{r^2} = 0$   
 $r = 5.4193$



$SA'' = 4\pi + \frac{4000}{r^3}$   
 $SA''(5.4193) > 0$

min at  $r = 5.4193$   
 $h = \frac{1000}{\pi \cdot 5.4193^2}$   
 $h = 10.8384$

$2\pi r$

$r$

$r$

$r \neq 0$

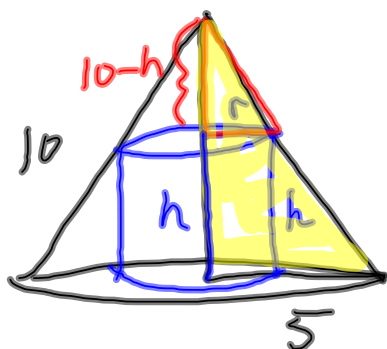
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A cylindrical can holds a fixed volume. Find the ratio of height to radius for the can with least surface area.

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A cylinder is inscribed in a cone of height 10 and radius 5. Find the volume of the largest ~~cone~~ cylinder



$$V = \pi r^2 h = \pi \left( \frac{10-h}{2} \right)^2 \cdot h$$

$$\frac{r}{5} = \frac{10-h}{10}$$

$$r = \frac{10-h}{10} \cdot 5 = \frac{10-h}{2}$$

similar  $\Delta$ 's

endpts:

$$h = 0$$

$$h = 10$$

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